



Complete Summary

TITLE

Pediatric heart surgery mortality: number of in-hospital deaths in patients undergoing surgery for congenital heart disease per 1,000 patients.

SOURCE(S)

AHRQ quality indicators. Pediatric quality indicators: technical specifications [version 3.2]. Rockville (MD): Agency for Healthcare Research and Quality (AHRQ); 2008 Feb 29. various p.

McDonald K, Romano P, Davies S, Haberland C, Geppert J, Ku A, Choudhry K. Measures of pediatric health care quality based on hospital administrative data: the pediatric quality indicators. Rockville (MD): Agency for Healthcare Research and Quality (AHRQ); 2006 Sep. 130 p. [82 references]

Measure Domain

PRIMARY MEASURE DOMAIN

Outcome

The validity of measures depends on how they are built. By examining the key building blocks of a measure, you can assess its validity for your purpose. For more information, visit the [Measure Validity](#) page.

SECONDARY MEASURE DOMAIN

Does not apply to this measure

Brief Abstract

DESCRIPTION

This measure is used to assess the number of in-hospital deaths in patients undergoing surgery for congenital heart disease per 1,000 patients.

RATIONALE

This indicator was developed as part of the Agency for Healthcare Research and Quality's (AHRQ's) Inpatient Quality Indicator measure set and is based on an indicator developed by Kathy Jenkins and colleagues. Dr. Jenkins developed this indicator based on physician input and empirical analyses (Jenkins, et al.,

Pediatrics 1995). Unlike other Inpatient Quality Indicators, this indicator also includes a tailored risk adjustment system, which estimates risk for patients based on procedure.

The evidence for the validity of this indicator comes from two sources. First, three studies (including one that used prospectively collected clinical data) have reported an association between hospital volume and mortality following pediatric cardiac surgery. Using a multivariate model that included age, complexity category, and four comorbidities, Hannan, et al. (Hannan, et al., Pediatrics 1998) found 8.26% risk-adjusted mortality at hospitals with fewer than 100 cases per year, versus 5.95% at higher volume hospitals (an effect limited to surgeons who performed at least 75 cases per year). Two other studies using hospital discharge data from California and Massachusetts found similar effects of hospital volume (Jenkins, et al., Pediatrics 1995; Sollano, et al., J Thorac Cardiovasc Surg 1999). The consistent association between volume and risk-adjusted mortality supports the validity of both measures of performance (see the related National Quality Measures Clearinghouse [NQMC] summary of the AHRQ Pediatric Quality Indicator [PDI] measure, [Pediatric heart surgery: volume](#), and is consistent with the hypothesis that more experience leads to improved technical skills and better outcomes. Other studies from single centers have confirmed this hypothesis by demonstrating improvements in mortality over time for a variety of procedures (Cetta, et al., J Am Coll Cardiol 1996; Iannettoni, et al., J Thorac Cardiovasc Surg 1994; Gelatt, et al., J Am Coll Cardiol 1997).

The second source of evidence is that cardiopulmonary bypass or aortic crossclamp time has been repeatedly associated with postoperative mortality, adjusting for a variety of patient characteristics (Knott-Craig, et al., J Thorac Cardiovasc Surg 1995; Gentles, et al., J Thorac Cardiovasc Surg 1997; Kaulitz, et al., J Thorac Cardiovasc Surg 1996; Fontan, et al., Circulation 1990). This relationship has been demonstrated not just for the Fontan procedure, but also for the Norwood procedure for hypoplastic left heart syndrome (Kern, et al., Am J Cardiol 1997). Experienced surgeons and surgical teams should be able to reduce cardiopulmonary bypass or aortic cross-clamp time, thereby improving postoperative mortality. It should be noted that patient-level reduction in mortality does not necessarily correspond with provider-level mortality. It is unknown how implementing these processes of care would actually affect provider-level mortality rates.

PRIMARY CLINICAL COMPONENT

Pediatric heart surgery; congenital heart disease; mortality

DENOMINATOR DESCRIPTION

Discharges under age 18 with International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) procedure codes for congenital heart disease in any field or non-specific heart surgery in any field with ICD-9-CM diagnosis of congenital heart disease in any field

Exclude cases:

- Major Diagnostic Category (MDC) 14 (pregnancy, childbirth and puerperium)

- with transcatheter interventions as single cardiac procedures, performed without bypass but with catheterization
- with septal defects as single cardiac procedures without bypass
- heart transplant
- premature infants with patent ductus arteriosus (PDA) closure as only cardiac procedure
- age less than or equal to 30 days with PDA closure as only cardiac procedure
- missing discharge disposition (DISP=missing)
- transferring to another short-term hospital (DISP=2)
- newborns with birth weight less than 500 grams

Note: Refer to the original measure documentation for specific ICD-9-CM codes.

NUMERATOR DESCRIPTION

Number of deaths among cases meeting the inclusion and exclusion rules for the denominator with a code of pediatric heart surgery in any procedure field with International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis of congenital heart disease in any field

Note: Refer to the original measure documentation for specific ICD-9-CM codes.

Evidence Supporting the Measure

EVIDENCE SUPPORTING THE CRITERION OF QUALITY

- A formal consensus procedure involving experts in relevant clinical, methodological, and organizational sciences
- One or more research studies published in a National Library of Medicine (NLM) indexed, peer-reviewed journal

Evidence Supporting Need for the Measure

NEED FOR THE MEASURE

Variation in quality for the performance measured

EVIDENCE SUPPORTING NEED FOR THE MEASURE

Hannan EL, Racz M, Kavey RE, Quaegebeur JM, Williams R. Pediatric cardiac surgery: the effect of hospital and surgeon volume on in-hospital mortality. *Pediatrics* 1998 Jun;101(6):963-9. [PubMed](#)

State of Use of the Measure

STATE OF USE

Current routine use

CURRENT USE

Internal quality improvement
Quality of care research

Application of Measure in its Current Use

CARE SETTING

Hospitals

PROFESSIONALS RESPONSIBLE FOR HEALTH CARE

Physicians

LOWEST LEVEL OF HEALTH CARE DELIVERY ADDRESSED

Single Health Care Delivery Organizations

TARGET POPULATION AGE

Age less than 18 years

TARGET POPULATION GENDER

Either male or female

STRATIFICATION BY VULNERABLE POPULATIONS

Unspecified

Characteristics of the Primary Clinical Component

INCIDENCE/PREVALENCE

Unspecified

ASSOCIATION WITH VULNERABLE POPULATIONS

Unspecified

BURDEN OF ILLNESS

See the "Rationale" field.

UTILIZATION

Unspecified

COSTS

Unspecified

Institute of Medicine National Healthcare Quality Report Categories

IOM CARE NEED

Getting Better

IOM DOMAIN

Effectiveness

Data Collection for the Measure

CASE FINDING

Users of care only

DESCRIPTION OF CASE FINDING

Discharges under age 18 with International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) procedure codes for congenital heart disease in any field or non-specific heart surgery in any field with ICD-9-CM diagnosis of congenital heart disease in any field (see the "Denominator Inclusions/Exclusions" field)

DENOMINATOR SAMPLING FRAME

Patients associated with provider

DENOMINATOR INCLUSIONS/EXCLUSIONS

Inclusions

Discharges under age 18 with International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) procedure codes for congenital heart disease in any field or non-specific heart surgery in any field with ICD-9-CM diagnosis of congenital heart disease in any field

Exclusions

Exclude cases:

- Major Diagnostic Category (MDC) 14 (pregnancy, childbirth and puerperium)
- with transcatheter interventions as single cardiac procedures, performed without bypass but with catheterization
- with septal defects as single cardiac procedures without bypass
- heart transplant
- premature infants with patent ductus arteriosus (PDA) closure as only cardiac procedure
- age less than or equal to 30 days with PDA closure as only cardiac procedure
- missing discharge disposition (DISP=missing)

- transferring to another short-term hospital (DISP=2)
- newborns with birth weight less than 500 grams

Note: Refer to the original measure documentation for specific ICD-9-CM codes.

RELATIONSHIP OF DENOMINATOR TO NUMERATOR

All cases in the denominator are equally eligible to appear in the numerator

DENOMINATOR (INDEX) EVENT

Clinical Condition
Institutionalization
Therapeutic Intervention

DENOMINATOR TIME WINDOW

Time window is a single point in time

NUMERATOR INCLUSIONS/EXCLUSIONS

Inclusions

Number of deaths among cases meeting the inclusion and exclusion rules for the denominator with a code of pediatric heart surgery in any procedure field with International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis of congenital heart disease in any field

Note: Refer to the original measure documentation for specific ICD-9-CM codes.

Exclusions

Unspecified

MEASURE RESULTS UNDER CONTROL OF HEALTH CARE PROFESSIONALS, ORGANIZATIONS AND/OR POLICYMAKERS

The measure results are somewhat or substantially under the control of the health care professionals, organizations and/or policymakers to whom the measure applies.

NUMERATOR TIME WINDOW

Institutionalization

DATA SOURCE

Administrative data

LEVEL OF DETERMINATION OF QUALITY

Not Individual Case

OUTCOME TYPE

Clinical Outcome

PRE-EXISTING INSTRUMENT USED

Unspecified

Computation of the Measure

SCORING

Rate

INTERPRETATION OF SCORE

Better quality is associated with a lower score

ALLOWANCE FOR PATIENT FACTORS

Analysis by high-risk subgroup (stratification on vulnerable populations)
Analysis by subgroup (stratification on patient factors, geographic factors, etc.)
Risk adjustment method widely or commercially available

DESCRIPTION OF ALLOWANCE FOR PATIENT FACTORS

Risk adjustment of the data is recommended using, at minimum, birthweight, age in days, age and the Risk-adjustment for Congenital Heart Disease (RACHS-1)*.

Application of multivariate signal extraction (MSX) to smooth risk adjusted rates is also recommended.

***Note:** Information on the RACHS-1 system is available at
http://www.ncbi.nlm.nih.gov/pubmed/15283367?ordinalpos=17&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVDocSum.

STANDARD OF COMPARISON

Internal time comparison

Evaluation of Measure Properties

EXTENT OF MEASURE TESTING

The development of the Agency for Healthcare Research and Quality (AHRQ) Pediatric Quality Indicators utilizes a four pronged approach: identification of candidate indicators, literature review, empirical analyses, and panel review. Candidate indicators were identified through both published literature and a brief survey of national organizations. Literature review provided descriptions and evaluations of some candidate indicators and the underlying relationship to quality

of care. Empirical analyses were conducted to explore alternative definitions; to assess nationwide rates and hospital variation; and to develop appropriate methods to account for variation in risk. Clinical panel review helped to refine indicator definitions and risk groupings, and to establish face validity in light of the limited evidence from the literature for most pediatric indicators. Information from these sources was used to specify indicator definitions and make recommendations to AHRQ regarding the best indicators for inclusion in the pediatric indicator set.

A structured review of each indicator was undertaken to evaluate face validity (from a clinical perspective). This process mirrored that undertaken during the initial development of the Patient Safety Indicators. Specifically, the panel approach established *consensual validity*, which "extends face validity from one expert to a panel of experts who examine and rate the appropriateness of each item...." The methodology for the structured review was adapted from the RAND/UCLA Appropriateness Method and consisted of an initial independent assessment of each indicator by clinician panelists using an initial questionnaire, a conference call among all panelists, followed by a final independent assessment by clinician panelists using the same questionnaire. The panel process served to refine definitions of some indicators, add new measures, and dismiss indicators with major concerns from further consideration.

Empirical analyses were conducted to provide the clinical panels and peer review participants with additional information about the indicators. These analyses were also used by the development team to test the alternative specifications and the relative contribution of indicator components in the numerator and denominator. These analyses were not intended to inform issues of precision, bias and construct validity, which will be addressed separately. The data source used in the empirical analyses was the 2003 Kids' Inpatient Sample (KID).

Refer to the original measure documentation for additional details.

EVIDENCE FOR RELIABILITY/VALIDITY TESTING

Fitch K, Bernstein SJ, Aguilar MD, et al. The RAND/UCLA appropriateness method user's manual. Santa Monica (CA): RAND; 2001. 109 p.

Green L, Lewis F. Measurement and evaluation in health education and health promotion. Mountain View (CA): Mayfield Publishing Company; 1998.

McDonald K, Romano P, Davies S, Haberland C, Geppert J, Ku A, Choudhry K. Measures of pediatric health care quality based on hospital administrative data: the pediatric quality indicators. Rockville (MD): Agency for Healthcare Research and Quality (AHRQ); 2006 Sep. 130 p. [82 references]

Identifying Information

ORIGINAL TITLE

Pediatric heart surgery mortality (PDI 6).

MEASURE COLLECTION

[Agency for Healthcare Research and Quality \(AHRQ\) Quality Indicators](#)

MEASURE SET NAME

[Agency for Healthcare Research and Quality \(AHRQ\) Pediatric Quality Indicators](#)

DEVELOPER

Agency for Healthcare Research and Quality

ENDORSER

National Quality Forum

ADAPTATION

This measure was adapted from the AHRQ Inpatient Quality Indicators.

PARENT MEASURE

Pediatric heart surgery mortality rate (IQI 10) (Agency for Healthcare Research and Quality [AHRQ])

RELEASE DATE

2006 Feb

REVISION DATE

2008 Feb

MEASURE STATUS

This is the current release of the measure.

SOURCE(S)

AHRQ quality indicators. Pediatric quality indicators: technical specifications [version 3.2]. Rockville (MD): Agency for Healthcare Research and Quality (AHRQ); 2008 Feb 29. various p.

McDonald K, Romano P, Davies S, Haberland C, Geppert J, Ku A, Choudhry K. Measures of pediatric health care quality based on hospital administrative data: the pediatric quality indicators. Rockville (MD): Agency for Healthcare Research and Quality (AHRQ); 2006 Sep. 130 p. [82 references]

MEASURE AVAILABILITY

The individual measure, "Pediatric Heart Surgery Mortality (PDI 6)," is published in "Measures of Pediatric Health Care Quality Based on Hospital Administrative Data: The Pediatric Quality Indicators" and "AHRQ Quality Indicators. Pediatric Quality Indicators: Technical Specifications [version 3.2]." These documents are available in Portable Document Format (PDF) from the [Pediatric Quality Indicators Download](#) page at the Agency for Healthcare Research and Quality (AHRQ) Quality Indicators Web site.

For more information, please contact the QI Support Team at support@qualityindicators.ahrq.gov.

COMPANION DOCUMENTS

The following are available:

- AHRQ quality indicators. Pediatric quality indicators: software documentation [version 3.2] - SAS. Rockville (MD): Agency for Healthcare Research and Quality (AHRQ); 2008 Mar 10. 40 p. This document is available in Portable Document Format (PDF) from the [AHRQ Quality Indicators Web site](#).
- AHRQ quality indicators. Software documentation: Windows [version 3.1a]. Rockville (MD): Agency for Healthcare Research and Quality (AHRQ); 2007 Apr 6. 99 p. This document is available in PDF from the [AHRQ Quality Indicators Web site](#).
- Pediatric quality indicators (PedQI): covariates [version 3.1]. Rockville (MD): Agency for Healthcare Research and Quality (AHRQ); 2007 Mar 12. 52 p. This document is available in PDF from the [AHRQ Quality Indicators Web site](#).
- Pediatric quality indicators (PedQI): covariates (with POA) [version 3.1]. Rockville (MD): Agency for Healthcare Research and Quality (AHRQ); 2007 Mar 12. 52 p. This document is available in PDF from the [AHRQ Quality Indicators Web site](#).
- HCUPnet. [internet]. Rockville (MD): Agency for Healthcare Research and Quality (AHRQ); 2004 [accessed 2007 May 21]. [Various pagings]. HCUPnet is available from the [AHRQ Web site](#). See the related [QualityTools](#) summary.

NQMC STATUS

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